Application of: **Daniel Davidson MacFarlane Shearer, III, et al.**	Date: **23 December 2005**
Serial Number: **09/884,000**	Group Art Unit: **2642**
Filed: **19 June 2001**	Examiner: **Hector A. Agdeppa**
Title: ***"Remote Power Amplifier Linearization"***	Attorney Docket No.: **2277-010**

Assistant Commissioner for Patents
P.O. Box 1450
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APPELLANT'S BRIEF

Dear Sir:

This Brief is filed pursuant to a Notice of Appeal mailed on 27 October 2005 in the matter of the above-identified application.

Real Party in Interest

Intersil Americas, Inc., is the real party in interest and the assignee of this application.

Related Appeals and Interferences

Appellant is aware of no related appeals, interference, and/or other proceedings relevant to this discussion.

Status of Claims

Claims 1 through 26, of which claims 1, 7, 14, and 15 are independent claims, are presented herein. Claims 1 through 26, i.e., all claims, have been rejected. Claims 1 through 26, i.e., all claims, are on appeal.

Appendix A provides a clean copy of all claims on appeal.

Claims 1-5, 7-12, 14-20, and 22-24 are rejected under 35 U.S.C. 103(a) as obvious over what is alleged to be "appellants admitted prior art" in view of Black, U.S. Patent No. 6,397,070 (hereinafter Black).

Claims 6 and 25 are rejected under 35 U.S.C. 103(a) as obvious over what is alleged to be "appellants admitted prior art" in view of Black and further in view of Leyendecker, U.S. Patent No. 5,867,065 (hereinafter Leyendecker).

Claims 13 and 21 are rejected under 35 U.S.C. 103(a) as obvious over what is alleged to be "appellants admitted prior art" in view of Black and further in view of Cox et al., U.S. Patent No. 5,732,333 (hereinafter Cox).

Appendix B provides copies of the Black, Leyendecker, and Cox references.

Status of Amendments

No amendments have been filed subsequent to final rejection.

Summary of Claimed Subject Matter

Appendix C provides copies of six drawing sheets containing FIGs. 1-11, which are discussed herein.

The present invention pertains to an apparatus and method for remotely linearizing a power amplifier.

FIG. 1 shows a simplified block diagram of a point to multipoint communication system 20, which includes a hub radio 22 and any number of user radios 24 [page 8, lines 9-13]. Hub radio 22 communicates with user radios 24 over a forward link 26 and a reverse link 28 [page 8, lines 15-16].

Wireless communication signals 30 transmitted over forward and reverse links 26 and 28 are invariably corrupted by noise [page 8, lines 19-21]. Hub radio 22 may be locally linearized through the use of a transmitter with high quality components that do not require linearization, a power amplifier linearizer along with local linearization analysis circuits and processing capabilities to detect nonlinearities in a communication signal 30" transmitted from hub 22, or the like [page 8, lines 21-28].

Received communication signals 30' are low signal-to-noise ratio signals that have been corrupted by noise [page 9, lines 2-4]. However, acceptable linearization results may be obtained through the generation of a signal quality statistic. [page 9, lines 6-8].

FIG. 3 shows a block diagram of a user radio 24 including a receiver section 44, a transmitter section 46, and a controller

48 [page 10, lines 27-32]. Transmitter section 46 receives user payload data 38 and system control data 40 at a multiplexer (MUX) 50 in a modulator 52 [page 10, line 32, to page 11, line 2]. In this example, controller 48 provides system control data 40, and user payload data 38 originates from outside user radio 24 [page 11, lines 2-4].

Within modulator 52, multiplexer 50 is controlled by controller 48 to supply either user payload data 38 or system control data 40 to an input of a phase mapper 54 [page 11, lines 9-12]. For each unit interval 42, phase mapper 54 converts a number of bits appropriate to the selected modulation order into a symbol, represented as a constellation point 56 selected from a constellation 58 of quadrature phase points (depicted as 16-QAM in FIG 3) [page 11, lines 13-22].

Over time, phase mapper 54 provides a stream of constellation points 56 to a pulse shaping filter 60, which desirably implements a root Nyquist or other filter to spread the energy from each constellation point 56 over several unit intervals 42 in a manner conducive to subsequent demodulation in a receiver [page 11, lines 23-29].

An output of pulse shaping filter 60 is supplied to a peak-to-average amplitude reduction block 62, which reduces extreme amplitude peaks in the signal being constructed by modulator 52 so that a power amplifier need not linearly reproduce its input signal over as wide a dynamic amplitude range as would be otherwise required [page 12, lines 1-7]. Amplitude reduction block 62, whose algorithms may be altered from time to time, generates a modulated data stream 64 that serves as the output from

modulator 52 [page 12, lines 7-11].

Modulated data stream 64 is supplied to a power amplifier linearizer 66, which applies a transfer function to the signal represented by modulated data stream 64 that is proportional to the inverse of the transfer function of a downstream power amplifier [page 12, lines 12-18].

Linearizer 66 provides linearized data 68 to a digital-to-analog (D/A) converter 70, which couples to an up-conversion block 72 [page 12, lines 24-26].

FIG. 4 shows a trace 78 depicting a portion of the transfer function of a hypothetical power amplifier 74 [page 13, lines 11-14]. Without linearization, power amplifier 74 has a substantially linear range of operation 80, existing only at a limited input and output magnitude [page 13, lines 15-17]. The transfer function becomes non-linear when power amplifier 74 produces a signal above linear range 80, which would lead to spectral regrowth and operation outside a spectral template imposed by governmental regulations, thereby causing interference for users of adjacent spectrum [page 13, lines 17-23].

FIG. 4 also shows traces 82 and 84 depicting hypothetical linearizer transfer functions as may be implemented by power amplifier linearizer 66 [page 13, lines 24-26]. The purpose of implementing linearizer transfer functions 82 or 84 would be to cause the overall signal at the output of power amplifier 74 to exhibit as closely as possible the linear transfer function depicted in a trace 86 [page 13, lines 26-31].

At user radio 24 (FIG. 3), a communication signal 30" transmitted from hub radio 22 is received at an antenna 88 coupled to an RF section 90, which preferably generates an essentially baseband, digital form of signal communication signal 30" expressed as a complex data stream [page 14, lines 12-23]. This signal is routed to a first input of a phase rotator 92 used to close a carrier tracking loop that allows receiver section 44 to match and track the carrier frequency used by hub radio 22 [page 14, lines 24-28].

The signal output from phase rotator 92 is routed to an adaptive equalizer 94, which adapts itself to compensate for primarily linear distortions in the communication channel [page 14, line 31, to page 15, line 2]. The signal is then routed to a phase constellation error detector 100, which is part of the carrier tracking loop [page 15, lines 2-5 and 21-22]. Phase constellation error detector 100 determines the complex difference vector between a received phase state and the nearest ideal phase state, for each unit interval 42 [page 15, lines 22-25]. An output of phase constellation error detector 100 is routed to a loop filter 104, and then to a phase integrator 106, where the filtered phase error signal is transformed into a phase signal suitable for feeding back to phase rotator 92 [page 15, lines 25-32].

The signal output from adaptive equalizer 94 is routed to a decoder 96 and the conveyed data is extracted [page 15, lines 2-6]. The data extracted by decoder 96 is supplied to a local routing section 102, where user payload data 38 is routed outside user radio 24 and system control data 40 is routed to controller 48 [page 15, lines 13-16]. Controller 48 is configured to act upon

system control data 40, which includes commands which instruct user radio 24 to adjust the transfer function implemented in linearizer 66 [page 15, lines 16-20].

FIG. 5 shows a block diagram of a hub radio 22, which a transmitter section 108, a receiver section 110, and a controller 112 [page 16, lines 1-6]. Transmitter section 108 includes a modulator 114 that receives system control data 40 from controller 112 and user payload data 38 destined for a variety of different user radios 24 to produce a modulated data stream 116 [page 16, lines 7-11].

Modulated data stream 116 is routed to an optional power amplifier linearizer 118, which imposes a locally-determined transfer function on modulated data stream 116 and thereby generates a linearized data stream 120, which is then supplied to a digital-to-analog (D/A) converter 122 and passed to an up-conversion section 124 and ultimately amplified in a power amplifier 126 to generate communication signal 30", which is transmitted to user radios 24 over forward links 26 [page 16, lines 12-24].

Receiver section 110 includes an RF section 130, phase rotator 132, adaptive equalizer 134, phase constellation error detector 136, carrier tracking loop filter 138, and phase integrator 140 all coupled together [page 17, lines 18-22]. Communication signals 30' transmitted from a number of user radios 24 are received and converted into a baseband quadrature constellation point data stream 142 output from adaptive equalizer 134 [page 17, lines 22-26]. The assignment of time slots 34 defines which parts of data stream 142 apply to which user

radios 24 [page 17, lines 26-28]. Data stream 142 is supplied to a demodulator 144, which extracts and locally routes the conveyed data so that system control data 40 is routed to controller 112 while user data 38 is routed outside hub radio 22 [page 17, lines 28-32].

Grounds of Rejection to Be Reviewed on Appeal

The following grounds of rejection are presented for review:

1. Whether claims 1-26 are made obvious under 35 U.S.C. 103(a) over what is alleged to be "appellants' prior art" in view of Black either severally or further in view of Leyendecker or Cox.

Arguments

Grounds of Rejection 1 -- Claims 1-26

While a detailed description of the various different rejections of the different claims on appeal is set forth above in the Status of Claims section, for the purposes of review these rejections may be summarized as rejecting claims 1-26 under 35 U.S.C. 103(a) as being obvious over what is alleged to be "appellants' prior art" in view of Black, either severally or further in view of Leyendecker or Cox.

In regard to independent claims 1, 7, 14, and 15, the Final Office Action asserts that, since Black teaches a method and apparatus for estimating reverse link loading in a wireless communication system it would be obvious for the hub radio of Black to remotely adjust the performance of a user radio.

Appellants believe, as is set forth below in more detail, that Black is improperly applied against the independent claims and improperly combined with various problem-plagued conventional techniques generally discussed in the background section of Appellants' specification. Accordingly, appellants believe all independent claims should be found allowable. And, since the independent claims are allowable, all claims that depend therefrom should also be found allowable because the other prior art of record (e.g., Leyendecker and Cox) fail to teach or suggest the missing elements from Black.

Black teaches the monitoring of forward (hub-to-user) and reverse (user-to-hub) communication links with user radios. When call loading is excessive, the hub radio adjusts its

transmission so that a forward communication link is reduced in power. This reduction in power is then interpreted by the user radio in question as an increase in distance between the user radio and the hub radio. Note that an increase in distance has not actually occurred, but that the user radio merely interprets the reduction in power as if an increase in distance has occurred. The user radio then switches to a new hub radio, thereby relieving the call loading of the original hub radio. This does not constitute any teaching or suggestion of the subject matter claimed in any of appellants' independent claims. Reading the adjustment of a transmission characteristic of a user radio into Black evidences confusion between what appellants teach in their specification with what Black teaches. This constitutes hindsight and is not permitted.

Black does not teach what the appellants claim in independent claims 1, 7, 14, and 15, either alone or in combination with any of the material discussed in the background section of the appellants' specification. In claim 1, the appellants claim:

> A communication system having remote power amplifier linearization, said system comprising:
>
> at least one user radio having a power amplifier linearizer that applies a transfer function to a modulated data stream, is coupled to a power amplifier, and is configured to transmit a communication signal generated by said power amplifier of said user radio; and
>
> a hub radio configured to receive said communication signal transmitted from said at least one user radio, to generate a signal quality measurement for said communication signal, to formulate commands in response to said signal quality measurement for said communication signal, and to transmit said commands, wherein said one user radio is further configured to adjust said transfer function of said power amplifier linearizer of said user

radio in response to one of said commands so that said user radio power amplifier becomes remotely linearized.

Neither Black nor the material in the background of appellants' specification teach of a user radio having a power amplifier linearizer, nor does this material teach a hub radio that generates a to-be-transmitted control signal configured to instruct a user radio how to adjust its linearizer, nor does this material teach transmitting such a control signal to a user radio, nor does this material teach about a user radio using a received control signal to affect its power amplifier linearizer. It is only through hindsight that the Office Action may construe Black and/or the material in the background of appellants' specification to be similar in function and/or to contain components (i.e., the power amplifier linearizer) to the present invention.

It is the goal of the Black system to simply trick a legacy population of user radios into switching to a second hub radio to relieve the loading burden on a first hub radio. Were Black to be modified to fulfill the functions of the present invention, it would require significant investment in the measurement of the quality of the signals received from the user radios. And, it would still be incompatible with the legacy population of user radios. So it would require further investment in the modification of the legacy population of user radios so that they would then "adjust said transfer function of said power amplifier linearizer of said user radio in response to one of said commands," as recited in claim 1. Such investment would deny Black the ability to simply and quickly trick user radios into switching to hub radio to relieve the loading burden of the hub radio. Black teaches away from such

massive modifications. Therefore, it would not have been obvious to one of ordinary skill in the art to modify Black to fulfill the functions of or contain the components of the present invention.

The Final Office Action implicitly and/or explicitly acknowledges that Black and appellants' background material fail to suggest of the claimed subject matter but summarily and gratuitously concludes that an "idea" of using base and user radios "can be" applied to appellants background-discussed subject matter for linearization purposes. It has been well established that a "can be" analysis is a notoriously improper obviousness analysis. As stated in *In re Laskowski*, 10 USPQ2d 1397, 1398-1399 (Fed. Cir. 1989):

> [1] Although the Commissioner suggests that Hoffman could readily be modified to form the Laskowski structure, "(t)he mere fact that the prior art could be so modified would not have made the modification obvious unless the prior art suggested the desirability of the modification." *In re Gordon*, 733 F.2d 900, 902, 221 USPQ 1125, 1127 (Fed. Cir. 1984). See also, e.g., *Interconnect Planning Corp. v. Feil*, 774 F.2d 1132, 1143, 227 USPQ 543, 551 (Fed. Cir. 1985; *In re Grabiak*, 769 F2d 729, 731, 226 USPQ 870, 872 (Fed. Cir. 1985; *In re Sernaker*, 702 F.2d 989, 994, 217 USPQ 1,5 (Fed. Cir. 1983).
>
> The prior art does not suggest Laskowski's modification of the Hoffman band saw wheel, or provide any reason or motivation to make that modification. *In re Regel*, 526 F.2d 1399, 1403 n.6, 188 USPQ 136,139 n.6 (CCPA 1975) ("there must be some logical reason apparent from positive, concrete evidence of record which justifies a combination of primary and secondary references") (*citing In re Stemniski*, 444 F.2d 581, 17 USPQ 343 (CCPA 1971)). We agree with the Commissioner that the suggestion to modify the Hoffman structure need not be found in Hoffman. In this case, however, the only source of the suggestion is Laskowski; there

> is no prior art teaching that would provide the motivation of using a loosely fitting tire, rising above the pulley flanges, to support the saw blade. *See In re Geiger*, 815 F.2d 686, 688, 2 USPQ2d 1276, 1278 (Fed. Cir. 1987) (obviousness can not be established by combining pieces of prior art absent some "teaching, suggestion, or incentive supporting the combination"); *In re Cho*, 813 F.2d 378,382, 1 USPQ2d 1662, 1664 (Fed. Cir. 1987) (discussing the Board's holding that "the artisan would have been motivated" to combine the references); *In re Deminski*, 796 F.2d 436, 443, 230 USPQ 313, 316 (Fed. Cir. 1986) (impropriety of hindsight reconstruction); *In re Donohue*, 766 F.2d 531, 534, 226 USPQ 619, 622 (Fed. Cir. 1985) (referring to the "suggestion or motivation to combine teachings" in rejections for obviousness) (*citing In re Samour*, 571 F.2d 559, 563, 197 USPQ 1, 4-5 (CCPA 1978)); *In re Clinton* 527 F.2d 1226, 1228, 188 USPQ 365, 367 (CCPA 1976) (holding that "a person of ordinary skill in the art would have sufficient motivation to combine" the separate steps); *In re Boe*, 505 F.2d 1297, 1299, 184 USPQ 38, 40 (CCPA 1974) (discussing "[t]he main motivation for combining" two prior art references).

The assertion by the Final Office Action that an "idea" from Black can be applied to prior systems discussed in the background section of appellants' specification and that therefore appellants claims are obvious falls far short of the legally required obviousness standards. Worse, that "idea" is acknowledged by the Office Action to be a connived distortion from what Black truly and reasonably teaches to those skilled in the art about cell loading (see the top of page 4 of the Office Action where the Final Office Action acknowledges that Black's teaching regards cell loading).

The legal requirements of an obviousness analysis, as set forth in *In re Laskowski*, *supra*, and elsewhere is that some motivation or logical explanation must exist to support a combination of references. Perhaps the Final Office Action

attempts to express such a motivation in the top paragraph on page 4 by alleging that Black may be modified to increase accuracy. But this is an illogical motivation. Increasing the accuracy of Black would be directed to increased accuracy in cell call loading. This is completely irrelevant to the present invention as claimed. It is grossly illogical to believe that more accuracy in cell call loading has anything to do with configuring transfer functions for power amplifier linearization.

The Final Office Action may be interpreted as attempting to state yet another motivation for combining dissimilar teachings in the final sentence of the top paragraph on page 4. In this sentence the Final Office Action references but then misrepresents the substance of a passage listed on pages 4 and 5 of appellants' own specification. This sentence then alleges that the appellants themselves teach a motivation that supports the allegedly obvious combination for using remote rather than local power amplifier linearization. Note that the Final Office Action misrepresents appellants' discussion as being directed toward using predetermined transfer functions, when the referenced passage actually discusses a problem directed to using predetermined training sequences in order for local linearization analysis circuitry to determine a suitable linearizer transfer function. Notwithstanding the misrepresentation, as directly admitted by the Final Office Action, this alleged motivation comes from appellants specification. Appellants' own teaching cannot amount to a motivation for combining prior art. Such motivation must come from the prior art (see *In re Laskowski, supra*). This contrived motivation provides additional very strong evidence as to the

improper use of hindsight in making an obviousness analysis, indicating that the entire analysis is improper.

The appellants believe that independent claim 1 is allowable over Black, either alone or in combination with material discussed in appellants' background section, in that neither Black nor the material discussed in appellants' background section teach what is claimed, to wit, the adjustment of a user radio power amplifier linearizer transfer function in response to a command from a hub radio. Thus, their combination cannot resemble the invention claimed in claim 1. Moreover, there is no suggestion motivation for making the proposed combination.

While the above discussion provides ample reason to find independent claim 1 allowable, additional reasons also lead to the same conclusion. The Final Office Action's rejection of claim 1 relies heavily upon prior conventional linearizer techniques discussed in the background section of appellants' own application, but the Final Office Action seems to have ignored the discussion of all the problems with those prior techniques discussed in appellants' background section. Page 3 of appellants' background section discusses the problems associated with non-compliant user radios. Page 4 of appellants' background section discusses the problems of cost, complexity, power consumption, weight, and size in using conventional local linearization in user radios. And, the bottom of page 4 through the top of page 5 presents a discussion of a problem associated with the conventional linearization practice of using training sequences to determine linearizer transfer functions. Clearly, the prior art techniques discussed in appellants' specification do not address or provide solutions

for these problems. Rather, these prior art techniques are the causes of the problems. Moreover, Black does not address these problems either because Black is concerned with call loading.

As established long ago in *In re Shaffer*, 108 USPQ 323, 329 (CCPA 1956):

> In fact, a person having the references before him who was not cognizant of appellant's disclosure would not be informed that the problem solved by appellant ever existed. Therefore, can it be said that these references which never recognized appellant's problem would have suggested its solution? We think not, and therefore feel that the references were improperly combined since there is no suggestion in either of the references that they can be combined to produce appellant's result.

Long-established patent law insists that the appellants' problem is relevant and that, when proposed references fail to recognize the appellants' problem, there is no suggestion to support a combination of such proposed references. This is precisely the situation for appellants' here. Neither reference relied upon by the Final Office Action consider appellants' problem. In fact, the techniques discussed in the background of appellants' own specification and relied upon in the rejection of the Final Office Action suffer from the very problems that appellants' claimed invention is provided to solve.

Accordingly, the prior art the Final Office Action alleges to be combinable to render appellants' claim 1 obvious not only fails to recognize the problems that appellants' invention is attempting to solve, but at best suffers from those very same problems. Appellants believe that independent claim 1 is also allowable over these references because long-established patent law insists that such references are not properly combinable.

Independent claim 7 is specifically directed to a hub radio. But Black, either alone or in combination with the other references, fails to teach or suggest "a controller configured to estimate a power amplifier linearizer transfer function in response to said signal quality measurement" as recited therein.

Independent claim 14 is specifically directed to a user radio. But Black, either alone or in combination with the other references, fails to teach or suggest "a controller coupled to said receiver and said power amplifier linearizer, said controller being configured to adjust said transfer function in response to said commands so that said power amplifier becomes remotely linearized," as claimed in claim 14. The commands referred to in this passage of claim 14 are received "from outside said user radio via wireless communication."

Independent claim 15 is directed to a method that applies to a communication system. The method recites activities that take place at first and second sites, which in one embodiment may be viewed as being a user radio and hub. Black, either alone or in combination with the recited prior art, fails to teach or suggest the recited activities for the same reasons that are presented above in connection with claim 1.

Accordingly, the appellants believe independent claims 7, 14, and 15 to be allowable for substantially the same reasons as are set forth above in connection with claim 1. Appellants respectfully request the Board reconsider all independent claims, namely claims 1, 7, 14, and 15.

In regard to claims 2-5, 8-12, 16-20, 22-24, and 26, claims 2-5 are dependent from independent claim 1, claims 8-12 are dependent from independent claim 7, and claims 16-20, 22-24, and 26 are dependent from independent claim 15. Inasmuch as appellants believe independent claims 1, 7, and 15 to be allowable for reasons discussed hereinbefore, appellants believe claims 2-5, 8-12, 16-20, 22-24, and 26 to be allowable by reason of dependency from allowable base claims. Appellants respectfully request the Board reconsider claims 2-5, 8-12, 16-20, 22-24, and 26.

In regard to claims 6 and 25, the Final Office Action rejects claims 6 and 25 under 35 U.S.C. 103(a) as being obvious over what is alleged to be "appellants' prior art" in view of Black and further in view of Leyendecker. Claim 6 is dependent from independent claim 1, and claim 25 is dependent from independent claim 15. Leyendecker adds nothing to Black that invalidates or the arguments put forth hereinbefore in conjunction with independent claims 1 and 15. Inasmuch as appellants believe independent claims 1 and 15 to be allowable for reasons discussed hereinbefore, appellants believe claims 6 and 25 to be allowable by reason of dependency from allowable base claims. Appellants respectfully request the Board reconsider claims 6 and 25.

In regard to claims 13 and 21, the Final Office Action rejects claims 13 and 21 under 35 U.S.C. 103(a) as being obvious over what is alleged to be "appellants' prior art" in view of Black and further in view of Cox. Claim 13 is dependent from independent claim 7, and claim 21 is dependent from independent claim 15. Cox adds nothing to Black that in any way invalidates

the arguments put forth hereinbefore in conjunction with independent claims 7 and 15. Inasmuch as appellants believe independent claims 7 and 15 to be allowable for reasons discussed hereinbefore, appellants believe claims 13 and 21 to be allowable by reason of dependency from allowable base claims. Appellants respectfully request the Board reconsider claims 13 and 21.

Conclusion

Claims 1-26 are included in this appeal. The rejection of claims 1-26 under 35 U.S.C. 103(a) as obvious over appellants' prior art in view of Black either severally or in combination with Leyendecker or Cox is believed to be improper. Black, either alone or in combination with the other prior art, fails to teach what is claimed in appellants' independent claims 1, 7, 14, and 15.

Appellants believe that the arguments above fully respond to every outstanding ground of rejection and that the contested claims should be found allowable.

Respectfully submitted,

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Appendix A -- Claims on Appeal

This Appendix is fourteen pages, including this cover page, and contains a clean double-spaced copy of all claims on appeal.

Claim 1: A communication system having remote power amplifier linearization, said system comprising:

at least one user radio having a power amplifier linearizer that applies a transfer function to a modulated data stream, is coupled to a power amplifier, and is configured to transmit a communication signal generated by said power amplifier of said user radio; and

a hub radio configured to receive said communication signal transmitted from said at least one user radio, to generate a signal quality measurement for said communication signal, to formulate commands in response to said signal quality measurement for said communication signal, and to transmit said commands, wherein said one user radio is further configured to adjust said transfer function of said power amplifier linearizer of said user radio in response to one of said commands so that said user radio power amplifier becomes remotely linearized.

Claim 2: A communication system as claimed in claim 1 wherein said hub radio is further configured to monitor a parameter of said communication signal received from said user radio at a plurality of points in time and to form said signal quality measurement for said communication signal in response to expressions of said parameter at each of said plurality of points in time to ameliorate the influence of noise.

Claim 3: A communication system as claimed in claim 1 wherein:

said communication system is a digital communication system in which, during each of a series of unit intervals, information is conveyed as a constellation point selected from a constellation of quadrature phase points; and

said hub radio is configured to form said signal quality measurement from baseband quadrature constellation points.

Claim 4: A communication system as claimed in claim 3 wherein said baseband quadrature constellation points are actual received constellation points and said hub radio is further configured to determine ideal constellation points and to calculate differences between said ideal constellation points and said actual received constellation points so that said signal quality measurements are responsive to magnitudes and phases of said differences.

Claim 5: A communication system as claimed in claim 1 wherein:

said hub radio comprises a power amplifier for use in communicating with said user radios; and

said hub radio power amplifier is locally linearized.

Claim 6: A communication system as claimed in claim 1 wherein:

said communication signals transmitted from said user radio conveys user payload data and system control data; and

said hub radio is configured to generate said signal quality measurement while said communication signal transmits said user payload data.

Claim 7: A hub radio for use in a communication system having remote power amplifier linearization, said hub radio comprising:

a receiver section configured to receive a wireless communication signal and to generate a signal quality measurement that is responsive to said communication signal;

a controller configured to estimate a power amplifier linearizer transfer function in response to said signal quality measurement and to formulate a command in response to said estimated power amplifier linearizer transfer function; and

a transmitter section configured to wirelessly transmit said command.

Claim 8: A hub radio as claimed in claim 7 wherein said receiver section monitors parameters of said communication signal at a plurality of points in time and forms said signal quality measurement in response to an expression of said parameters at each of said plurality of points in time to ameliorate the influence of noise.

Claim 9: A hub radio as claimed in claim 7 wherein:

said communication signal conveys information during each of a series of unit intervals as a constellation point selected from a constellation of quadrature phase points; and

said receiver section forms said signal quality measurement from baseband quadrature constellation points.

Claim 10: A hub radio as claimed in claim 9 wherein said baseband quadrature constellation points are actual received constellation points and at least one of said receiver section and said controller is configured to determine ideal constellation points and calculate differences between said ideal constellation points and said actual received constellation points.

Claim 11: A hub radio as claimed in claim 10 wherein said signal quality measurement is responsive to magnitudes of said differences.

Claim 12: A hub radio as claimed in claim 7 wherein said transmitter section comprises:

a power amplifier linearizer adapted to apply a transfer function to a modulated data stream and to generate a linearized data stream;

a power amplifier configured to amplify said linearized data stream; and

a local linearization analysis section coupled to said power amplifier linearizer and to said power amplifier to locally linearize said power amplifier.

Claim 13: A hub radio as claimed in claim 12 additionally comprising a coupler between an output of said power amplifier and an input of said receiver section for calibrating non-linearity in said receiver section.

Claim 14: A user radio for use in a communication system having remote power amplifier linearization, said user radio comprising:

a power amplifier linearizer adapted to apply a transfer function to a modulated data stream and generate a linearized data stream;

a power amplifier configured to amplify said linearized data stream and generate a communication signal;

a receiver section adapted to receive commands from outside said user radio via wireless communication; and

a controller coupled to said receiver and said power amplifier linearizer, said controller being configured to adjust said transfer function in response to said commands so that said power amplifier becomes remotely linearized.

Claim 15: In a communication system, a method for remote power amplifier linearization used in generating a communication signal transmitted from a first site for receipt at a second site, said method comprising:

a) receiving said communication signal at said second site;

b) generating a signal quality measurement at said second site, said signal quality measurement being determined from said communication signal received in said receiving activity a);

c) formulating a command at said second site in response to said signal quality measurement;

d) transmitting said command from said second site;

e) receiving said command at said first site;

f) adjusting, at said first site in response to said command, a transfer function applied to a modulated data stream by a power amplifier linearizer;

g) linearizing said modulated data stream in said power amplifier linearizer to generate a linearized data stream;

h) amplifying said linearized data stream in a power amplifier to generate said communication signal; and

i) transmitting said communication signal from said first site.

Claim 16: A method as claimed in claim 15 wherein said generating activity b) monitors parameters of said communication signal at a plurality of points in time and forms said signal quality measurement in response to expressions of said parameters at each of said plurality of points in time to ameliorate the influence of noise.

Claim 17: A method as claimed in claim 15 wherein:

said communication system is a digital communication system in which, during each of a series of unit intervals, information is conveyed as a constellation point selected from a constellation of quadrature phase points; and

said generating activity b) forms said signal quality measurement from baseband quadrature constellation points.

Claim 18: A method as claimed in claim 17 wherein said baseband quadrature constellation points are actual received constellation points and said generating activity b) comprises:

obtaining ideal constellation points; and

calculating differences between said ideal constellation points and said actual received constellation points.

Claim 19: A method as claimed in claim 18 wherein said signal quality measurement is responsive to magnitudes and phases of said differences.

Claim 20: A method as claimed in claim 15 additionally comprising:

achieving carrier synchronization at said second site prior to said formulating activity c); and

achieving symbol synchronization at said second site prior to said formulating activity c).

Claim 21: A method as claimed in claim 15 wherein:

said receiving activity a) receives said communication signal at a receiver section located at said second site;

said method additionally comprises receiving a locally generated calibration signal at said receiver section to determine non-linearity of said receiver;

said method additionally comprises generating said signal quality measurement for said locally generated calibration signal received at said receiver section; and

said formulating activity c) comprises compensating for said non-linearity of said receiver in formulating said command, said compensating activity occurring in response to said signal quality measurement for said locally generated calibration signal.

Claim 22: A method as claimed in claim 15 wherein, at said second site, a power amplifier linearizer has an output coupled to a power amplifier input, and said method additionally comprises locally linearizing said second site power amplifier.

Claim 23: A method as claimed in claim 15 wherein:

said activities a) - i) form a linearization feedback loop process which repeats to track changes in power amplifier linearization;

during an earlier iteration of said linearization feedback loop process said communication signal is transmitted from said first site at a first power level and a first energy per bit level; and

during a later iteration of said linearization feedback loop process said communication signal is transmitted from said first site at a second power level and a second energy per bit level, said second power level being greater than said first power level and said second energy per bit level being less than said first energy per bit level.

Claim 24: A method as claimed in claim 23 wherein said later iteration of said linearization feedback loop process occurs after a signal quality statistic derived from signal quality measurement indicates that said communication signal is in compliance with a predetermined spectral template.

Claim 25: A method as claimed in claim 15 wherein:

said activities a) - i) form a linearization feedback loop process;

said communication signal conveys user payload data and system control data at different times; and

said linearization feedback loop process takes place while said communication signal conveys user payload data.

Claim 26: A method as claimed in claim 15 wherein said communication signal is a first communication signal, said communication system includes a third site that transmits a second communication signal for receipt at said second site, and said method additionally comprises:

receiving said second communication signal at said second site;

generating, at said second site, a second signal quality measurement determined from said second communication signal;

formulating a second command at said second site in response to said second signal quality measurement;

transmitting said second command from said second site;

receiving said second command at said third site;

adjusting, at said third site in response to said second command, a second transfer function applied to a second modulated data stream by a second power amplifier linearizer;

linearizing said second modulated data stream in said second power amplifier linearizer to generate a second linearized data stream;

amplifying said second linearized data stream in a second power amplifier at said third site to generate said second communication signal; and

transmitting said second communication signal from said third site.

Appendix B -- Evidence

This Appendix is fifty-nine pages, including this cover page, and contains clean copies of all evidence (i.e., prior art references) under consideration. This evidence is listed below:

	Patent	U.S. Pat. No.	Pages
1.	Black	6,397,070	16
2.	Leyendecker	5,867,065	25
3.	Cox et al.	5,732,333	17

Appendix C -- Figures

This Appendix is seven pages, including this cover page, and contains six drawing sheets containing a clean copy of each of Figures 1 through 11. These drawing sheets have been formatted to fit this document for the convenience of the Board.

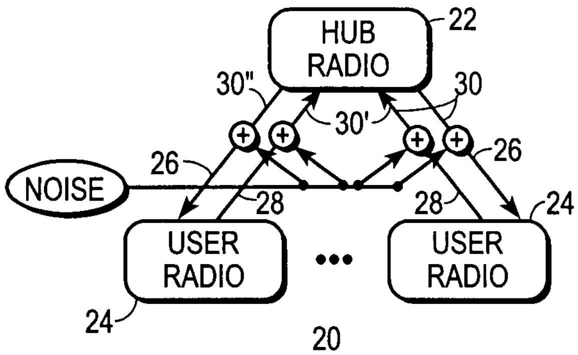


FIG. 1

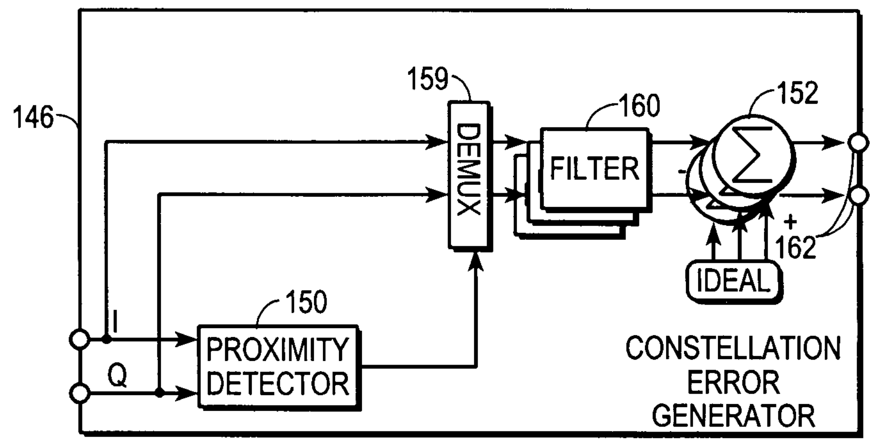


FIG. 6

FIG. 4

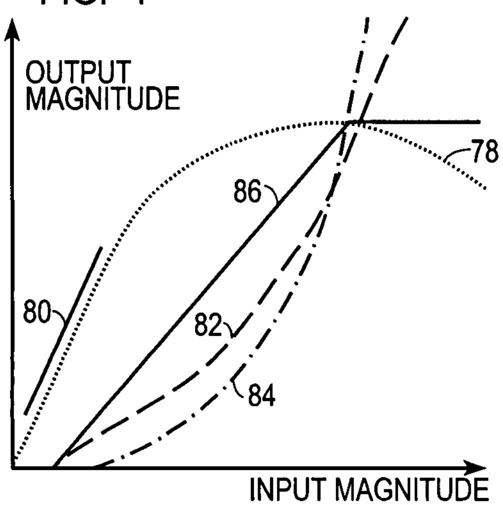
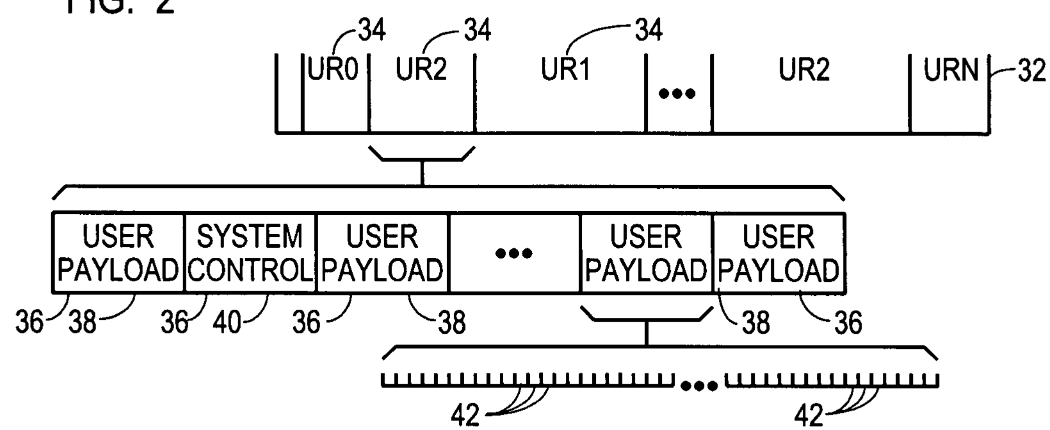


FIG. 2



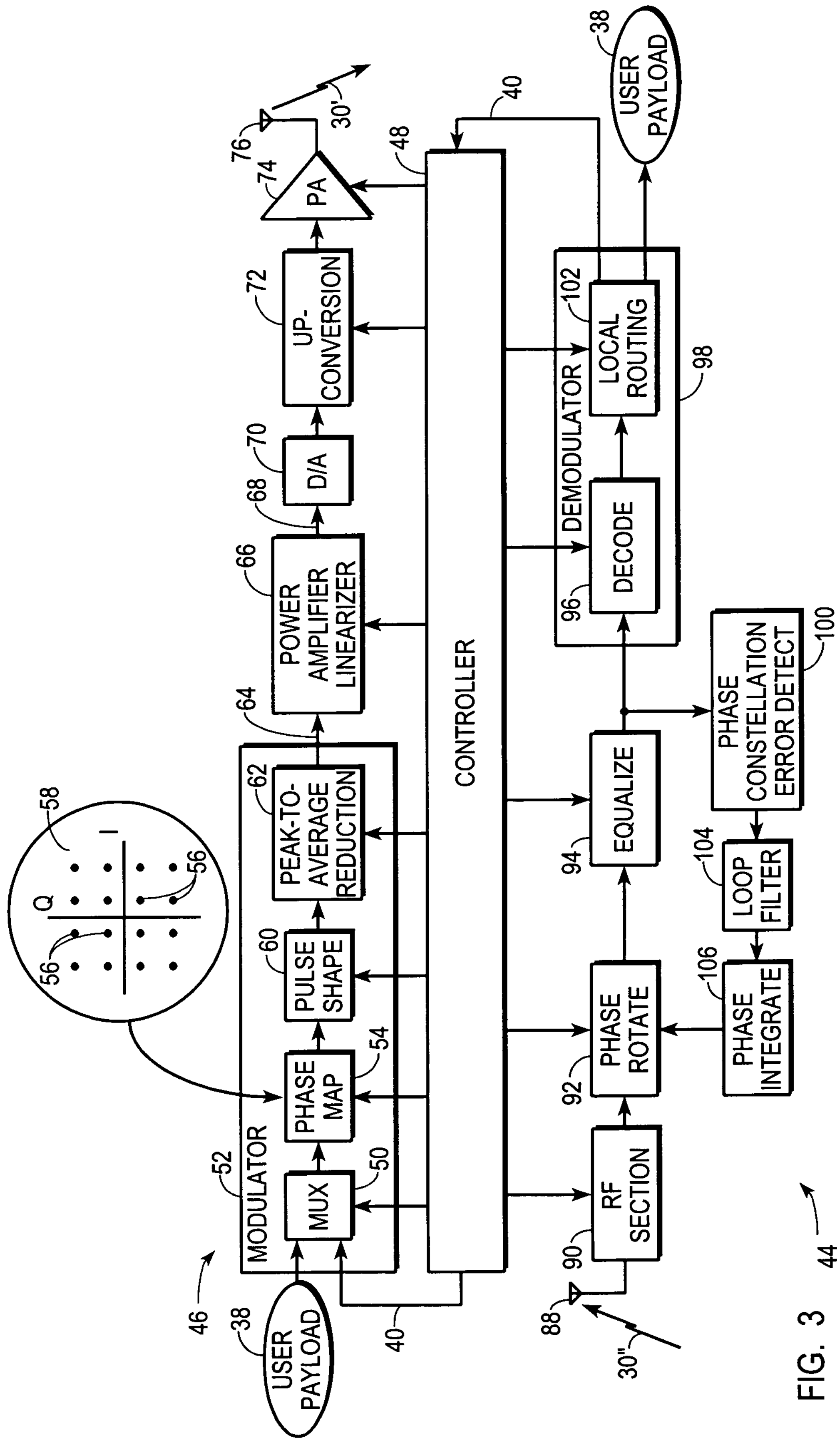

USER PAYLOAD
38
46
MODULATOR
52
MUX
50
PHASE MAP
54
PULSE SHAPE
60
PEAK-TO-AVERAGE REDUCTION
62
Q
I
56
58
64
POWER AMPLIFIER LINEARIZER
66
68
D/A
70
UP-CONVERSION
72
PA
74
76
30'
48
40
CONTROLLER
88
30"
RF SECTION
90
PHASE ROTATE
92
EQUALIZE
94
DECODE
96
DEMODULATOR
98
LOCAL ROUTING
102
PHASE CONSTELLATION ERROR DETECT
100
LOOP FILTER
104
PHASE INTEGRATE
106
24
44

FIG. 3

2277-020

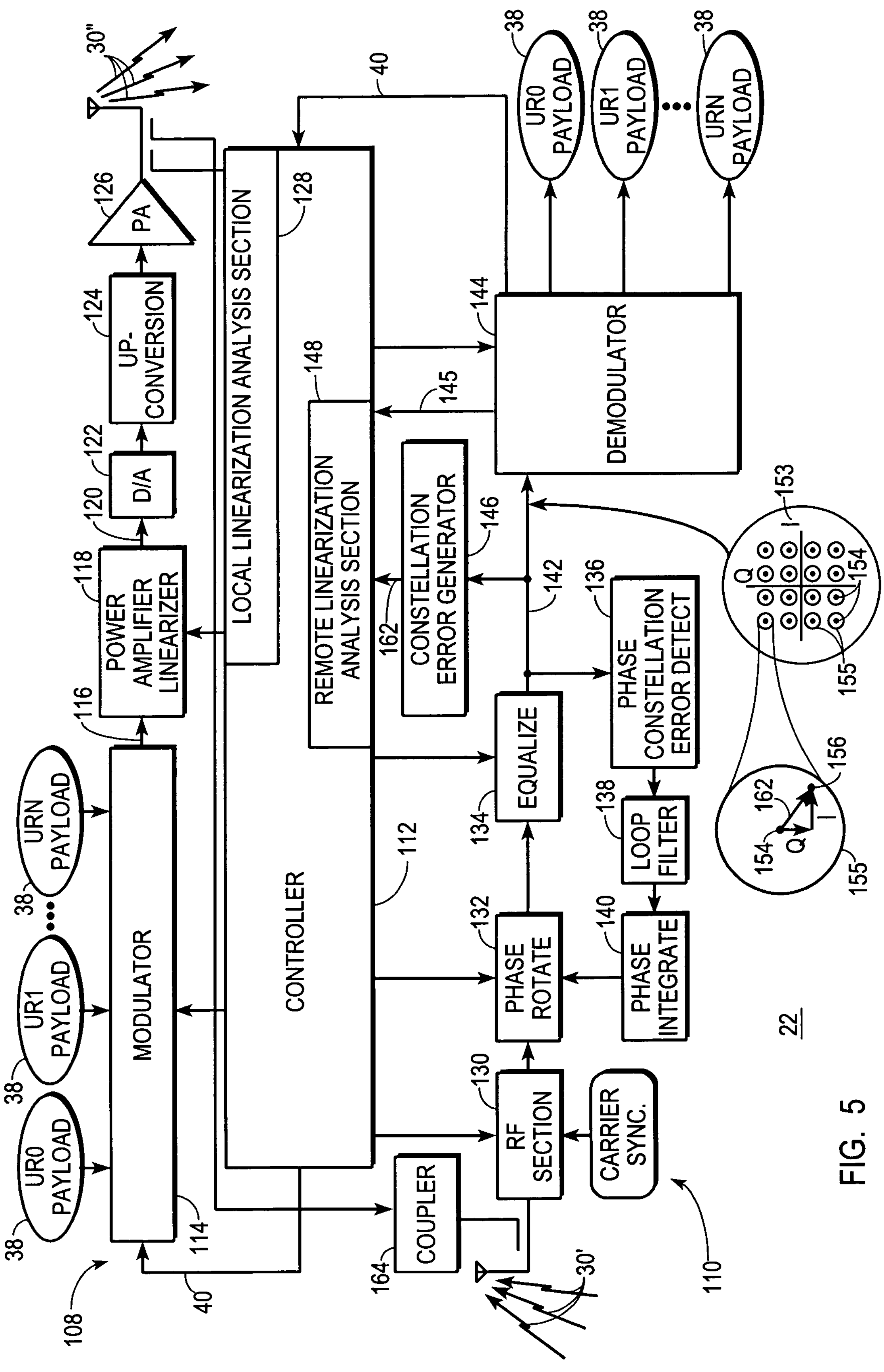
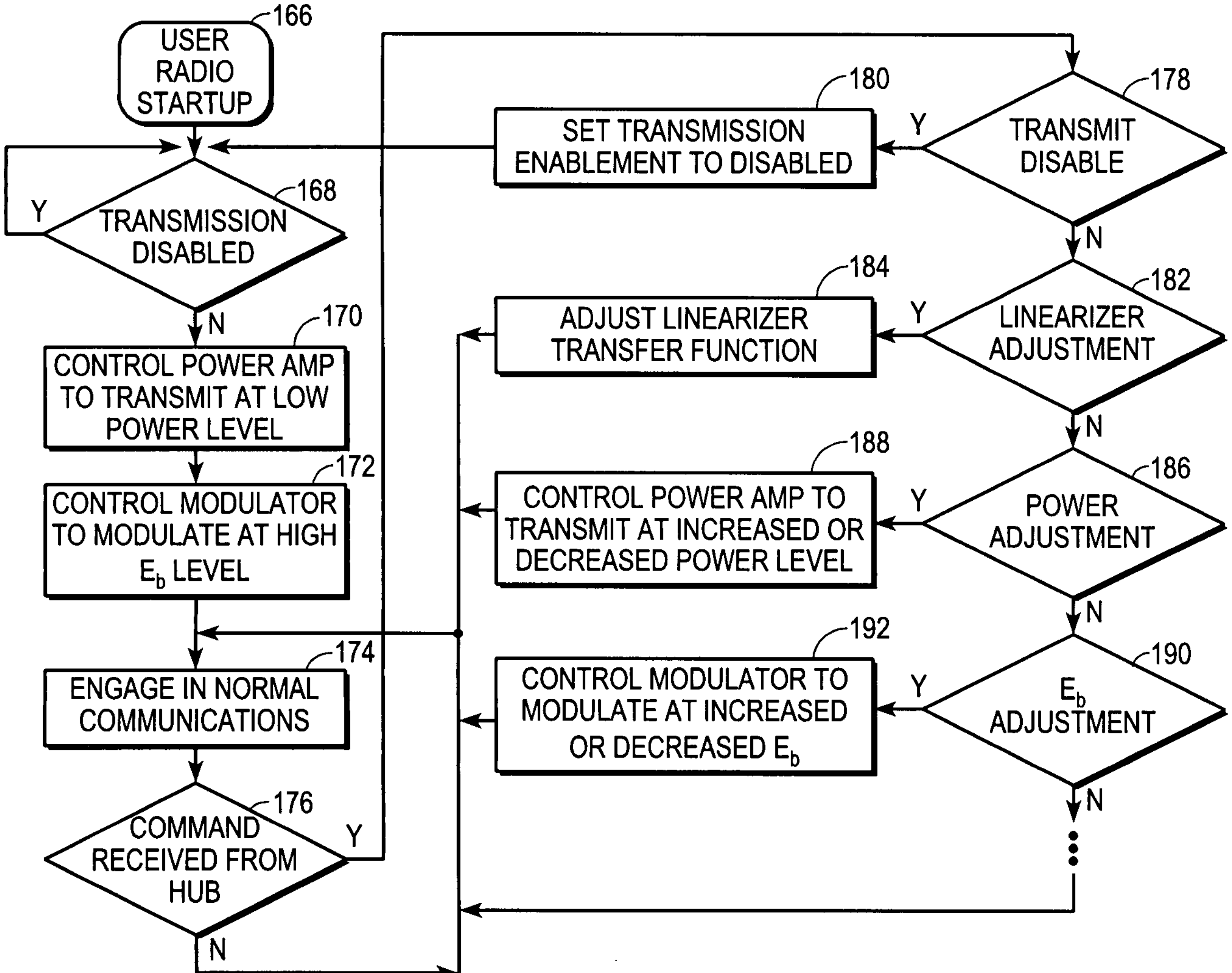


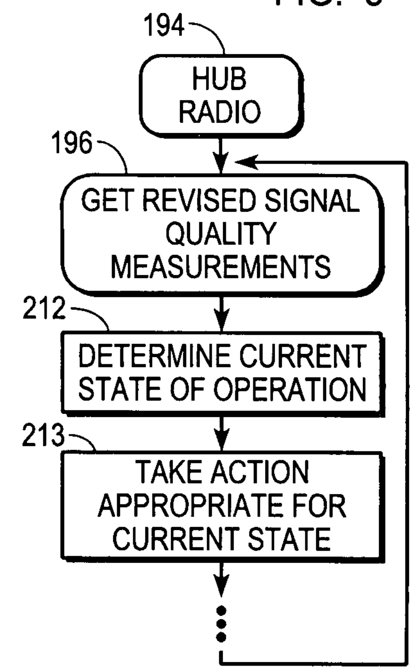
FIG. 5



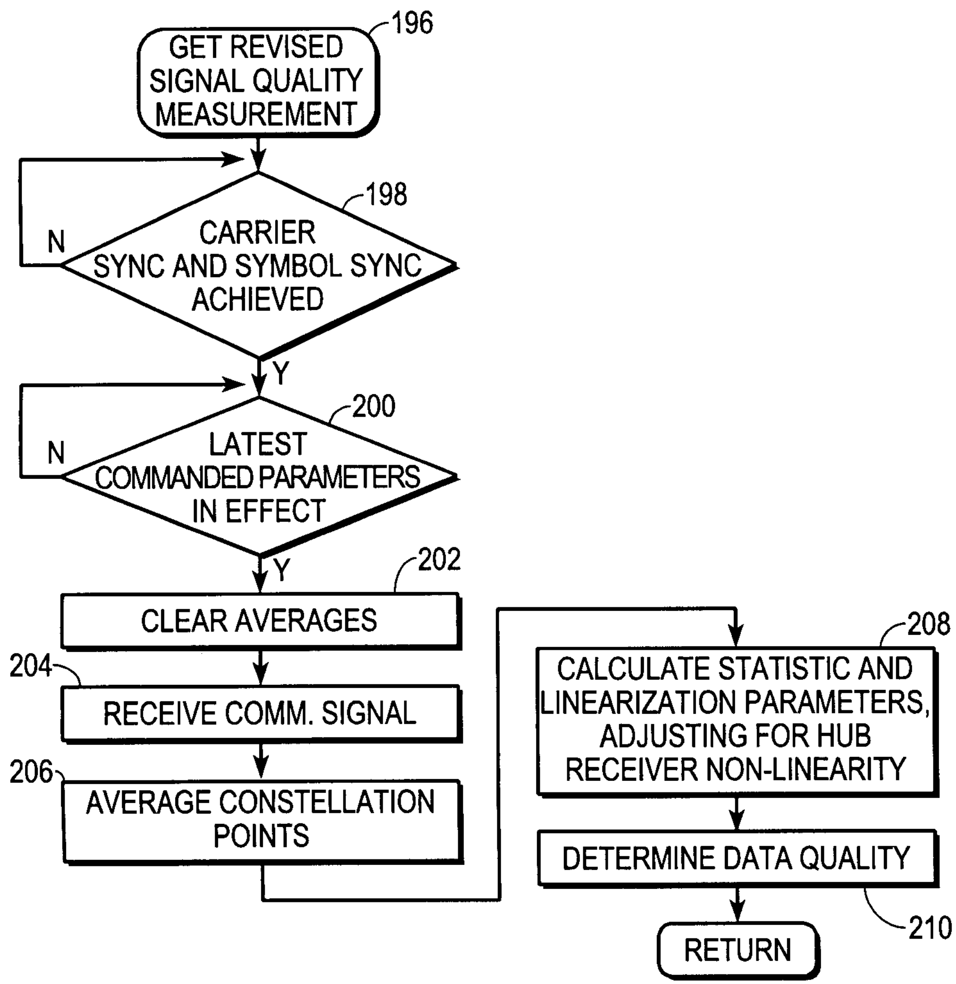
166
USER RADIO STARTUP
168
TRANSMISSION DISABLED
Y
N
170
CONTROL POWER AMP TO TRANSMIT AT LOW POWER LEVEL
172
CONTROL MODULATOR TO MODULATE AT HIGH E_b LEVEL
174
ENGAGE IN NORMAL COMMUNICATIONS
176
COMMAND RECEIVED FROM HUB
Y
N
178
TRANSMIT DISABLE
Y
N
180
SET TRANSMISSION ENABLEMENT TO DISABLED
182
LINEARIZER ADJUSTMENT
Y
N
184
ADJUST LINEARIZER TRANSFER FUNCTION
186
POWER ADJUSTMENT
Y
N
188
CONTROL POWER AMP TO TRANSMIT AT INCREASED OR DECREASED POWER LEVEL
190
E_b ADJUSTMENT
Y
N
192
CONTROL MODULATOR TO MODULATE AT INCREASED OR DECREASED E_b

FIG. 7

FIG. 8

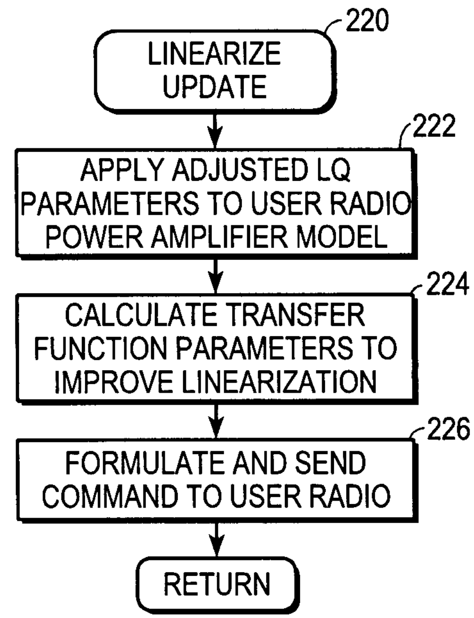


194
HUB RADIO
196
GET REVISED SIGNAL QUALITY MEASUREMENTS
212
DETERMINE CURRENT STATE OF OPERATION
213
TAKE ACTION APPROPRIATE FOR CURRENT STATE



GET REVISED SIGNAL QUALITY MEASUREMENT
196
CARRIER SYNC AND SYMBOL SYNC ACHIEVED
198
N
Y
LATEST COMMANDED PARAMETERS IN EFFECT
200
N
Y
CLEAR AVERAGES
202
RECEIVE COMM. SIGNAL
204
AVERAGE CONSTELLATION POINTS
206
CALCULATE STATISTIC AND LINEARIZATION PARAMETERS, ADJUSTING FOR HUB RECEIVER NON-LINEARITY
208
DETERMINE DATA QUALITY
210
RETURN

FIG. 9



LINEARIZE UPDATE
220
APPLY ADJUSTED LQ PARAMETERS TO USER RADIO POWER AMPLIFIER MODEL
222
CALCULATE TRANSFER FUNCTION PARAMETERS TO IMPROVE LINEARIZATION
224
FORMULATE AND SEND COMMAND TO USER RADIO
226
RETURN

FIG. 11

214

ACTIONS IN RESPONSE TO OPERATING STATES				
218 LQ -- OK; DQ -- OK	218 LQ -- HIGH; DQ -- OK	LQ -- OK OR HIGH; DQ -- LOW	218 LQ -- LOW; DQ -- OK	218 LQ -- LOW; DQ -- LOW
MAINTAIN CURRENT SETTINGS 216	DECREASE E_b INCREASE POWER 216	INCREASE POWER INCREASE E_b 216	220 LINEARIZE UPDATE DECREASE POWER REPEAT TRANSMIT DISABLE 216	220 LINEARIZE UPDATE INCREASE E_b DECREASE POWER REPEAT TRANSMIT DISABLE 216

FIG. 10

AF/2642
JFW

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant: Shearer, III, et al.

Serial No.: 09/884,000

Filed: 19 June 2001

For: *REMOTE POWER AMPLIFIER LINEARIZATION*

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23 Dec. 2005
Date

Lowell W. Gresham
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23 December 2005

Respectfully submitted,

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